

Claims

What is claimed is:

1. A method for correcting imbalance between in-phase and quadrature components of a received signal comprising the steps of:

adjusting a first phase angle to determining a peak amplitude for the in-phase component of the received signal;

adjusting a first phase angle to determining a peak amplitude for the quadrature component of the received signal;

adjusting a first phase angle to set the amplitudes for the in-phase and quadrature components of the received signal to be approximately equal; and

adjusting a second phase angle so that the inphase and quadrature components of the received signal are 90 degrees out of phase.

2. The method of claim 1, further comprising the step of mixing a low frequency signal with a local oscillator signal.

3. The method of claim 2, wherein a double sideband suppressed carrier signal is produced for correcting imbalance between in-phase and quadrature components of the received signal.

4. The method of claim 3, further comprising the step using the determined peak amplitudes to scale the gains of the in-phase and quadrature components to be equal.

5. A communication device for correcting imbalance between in-phase and quadrature components of a received signal comprising:
- a low frequency oscillator that produces a low frequency signal;
 - a high frequency oscillator that produces a high frequency signal;
 - a first mixer to multiply the signals produced by the low and high frequency oscillators that produces a double side-band suppressed carrier signal;
 - a second and third mixer to produce in-phase and quadrature components of the received signal from the double side-band suppressed carrier signal;
 - a first phase shifter circuit to adjust the phase of the double side band suppressed carrier input radio frequency calibration signal to determine the peak amplitudes of the in-phase and quadrature components of the received signal;
 - a gain scaling circuit to set the relative amplitudes of the in-phase and quadrature components of the received signal to be substantially equal;
 - a fourth mixer circuit to multiply the in-phase and quadrature components to produce a relative phase error signal; and
 - a second phase shifter circuit to adjust the relative phase between the in-phase and quadrature components of the received signal to be 90 degrees, by adjusting the relative phase difference between the high frequency oscillator inputs to the second and third mixers.
6. The communication device of claim 5, wherein the first phase shifter comprises a power detector circuit.
7. The communication device of claim 6, wherein the power detector compares the power in a signal to a desired level of power.
8. The communication device of claim 7, wherein the first phase shifter further comprises a loop filter.

9. The communication device of claim 8, wherein the first phase shifter further comprises an amplifier such that the voltage output from the first phase shifter is constant and independent of the amount of phase shift.

10. The communication device of claim 9, further comprising a phase locked loop circuit and a filter circuit connected to the high frequency oscillator.

11. A method for correcting imbalance between in-phase and quadrature components of a received signal comprising the steps of :

producing a low frequency signal;

producing a high frequency signal;

multiplying the low and high frequency signals to produce a double side-band suppressed carrier signal;

producing in-phase and quadrature components of the received signal from the double side-band suppressed carrier signal;

shifting the phase of the double side band suppressed carrier signal to determine the peak amplitudes of the in-phase and quadrature components of the received signal;

scaling the gain to set the relative amplitudes of the in-phase and quadrature components of the received signal to be substantially equal;

multiplying the in-phase and quadrature components to produce a relative phase error signal; and

shifting the relative phase between the in-phase and quadrature components of the received signal to be 90 degrees.

12. The method of claim 11, further comprising the step of detecting the power of phase shifter of the double side band suppressed carrier signal

13. The method of claim 12, further comprising the step of comparing the detected power to a desired level of power.

14. The method of claim 13, further comprising the step of providing a constant output voltage while shifting the relative phase of the double side band suppressed carrier signal.
15. The method of claim 14, further comprising the step of coupling the double side band suppressed carrier signal to a receiver's RF path at a low noise amplifier input.

16. A radio receiver comprising:

an antenna;

a quadrature receiver for receiving signals and converting the received signals into inphase baseband and a quadrature baseband signals;

a digital signal processor for performing the following tasks:

determining an imbalance in the quadrature receiver between the inphase and quadrature signals of the test signal under varying conditions,

generating a correction factor for at least some of the varying conditions, and

applying one or more correction factors to subsequently received inphase and quadrature baseband signals depending on a current condition to minimize an imbalance between the subsequently received inphase and quadrature baseband signals.

17. The radio receiver in claim 16, wherein one of the varying conditions is a changing gain of the baseband signals.

18. The radio receiver in claim 17, wherein one of the varying conditions is changing the phase relationship between the baseband signals.

19. The method of claim 3, further comprising the step of coupling the double side band suppressed carrier signal to a receiver's RF path at a low noise amplifier input terminal.

20. The communication device of claim 5 further comprising a means to couple the double side band suppressed carrier signal to the communication devices' RF path at a low noise amplifier input terminal.